INVERSE IMAGE REVERSING APPARATUS OF A MOBILE COMMUNICATION TERMINAL WITH INTEGRATED PHOTOGRAPHIC APPARATUS AND METHOD THEREOF

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CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Pursuant to 35 U.S.C. § 119(a), this application claims the benefit of earlier filing date and right of priority to the Korean Patent Application No. 2002-75478, filed on November 29, 2002, the content of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0002] The present invention relates to an image reversing apparatus of a mobile communication terminal with an integrated photographic apparatus and method thereof, and more particularly, to an image reversing apparatus of a mobile communication terminal with an integrated photographic apparatus and method thereof to correctly reproduce an inverted image.

DESCRIPTION OF RELATED ART

[0003] In general, mobile communication terminals include cellular phones or Personal Communication Systems (PCS) having wireless communication capabilities. As the need for video/image communication emerges along with voice communication, several types of

mobile communication terminals with an integrated photographic apparatus have been suggested to satisfy this demand.

[0004] Referring to FIG. 1, a folding type mobile terminal 10 is shown with a rotatable camera 16 mounted on the terminal 10. The folding type conventional mobile terminal 10 comprises a body 11, in which a printed circuit board 12 (partially shown) is installed. The terminal further comprises an upper folding portion 13 rotatably coupled to the lower folding portion 11 by using a hinge 15. The camera 16 is mounted at the hinge 15 and can rotate 180°. A liquid crystal display (LCD) screen 14 is mounted on the upper folding portion 13.

[0005] Generally, when the rotation angle of the camera 16 is approximately within 330° to 90° (based on 0° corresponding to the twelve o'clock position), such that the camera 16 is generally directed in a direction opposite the LCD screen 14, the reproduced image created by the camera 16 is correctly reproduced on the LCD screen 14 with respect to orientation. However, when the rotation angle of the camera 16 ranges approximately less than 330°, such that the camera 16 is generally directed in the same direction as the LCD screen 14, the reproduced image created by the camera is inversely reproduced on the LCD screen 14 with respect to orientation. In other words, the image is inverted so that it appears upside-down. Consequently, a correcting apparatus is required to allow for proper image reproduction.

[0006] An example of an image correcting apparatus in a mobile communication terminal having an integrated photographic apparatus is described in Japanese Patent No. 3116822, wherein a construction for reversing an inverse image is disclosed. Japanese Patent No. 3116822 describes the use of an angle sensor to detect an angle displacement that is generated when a camera body rotates on the basis of an optical axis of the lens. However, this construction is relatively complicated and large, resulting in increased fabrication cost and

possibly degraded accuracy. Therefore, an improved solution is needed to correctly display an inverted image reproduced by a rotating photographic apparatus of a mobile communication terminal.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to a mobile communication terminal with an integrated photographic apparatus that substantially obviates one or more problems due to limitations and disadvantages of the related art above.

[0008] An object of the present invention is to provide an inverse image reversing apparatus of a mobile communication terminal with an integrated photographic apparatus, wherein construction and cost of fabrication are simplified and reduced, respectively.

[0009] Another object of the present invention is to provide an inverse image reversing apparatus of a mobile communication terminal with an integrated photographic apparatus, wherein the accuracy of the reversed inverse image is enhanced.

[0010] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0011] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a mobile communication terminal comprising a photographic apparatus rotatively installed on the terminal. Further, a magnet, which generates a flux, is installed on the photographic apparatus. A magnetic flux sensor is also installed on the terminal so that an image produced by the

photographic apparatus is inverted when the magnetic flux sensor detects the magnetic flux. Rotation of the photographic apparatus a predetermined angle approximates the magnet to the magnetic flux detecting sensor.

[0012] According to one aspect of the present invention, the predetermined angle ranges from approximately 150° to approximately 180°. Also, the inverted image is reproduced on a display installed on the terminal.

[0013] According to another aspect of the present invention, the mobile communication terminal is a folding type mobile communication terminal which further comprises a lower body, an upper body having a lower surface, a hinge connection element rotatingly connecting the lower body to the upper body, a display which reproduces the image produced by the photographic apparatus, and a circuit board installed in the lower body. The display is installed on the lower surface of the upper body, and the circuit board receives a signal emitted by the magnetic flux sensor to invert the image produced by the photographic apparatus. Further, the photographic apparatus is rotatively installed on the terminal at the hinge connection element, and the magnetic flux sensor is installed on the circuit board. Finally, the magnet is installed on an inner circumferential surface of the photographic apparatus and may comprise an outer circumferential surface having a curvature approximating a curvature of the inner circumferential surface of the photographic apparatus.

[0014] According to another aspect of the present invention, the terminal may further comprise a first "C" shaped guide rail formed on the inner circumferential surface of the photographic apparatus, and a second "C" shaped guide rail formed opposite the first guide rail on the inner circumferential surface of the photographic apparatus a distance approximate to the length of the magnet. The first and second guide rails receive and fixedly secure the magnet to the photographic apparatus.

[0015] According to one aspect of an alternative embodiment of the present invention, a mobile communication terminal may comprise a photographic apparatus that is rotatively installed on the terminal. Further, a magnet, which generates a flux, is installed on the photographic apparatus. A magnetic flux sensor is also installed on the terminal so that an image produced by the photographic apparatus is inverted when the magnetic flux sensor does not detect the magnetic flux. Rotation of the photographic apparatus a predetermined angle approximates the magnet to the magnetic flux detecting sensor.

[0016] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to further describe the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0018] In the drawings:

FIG. 1 illustrates a type of a mobile communication terminal with an integrated photographic apparatus according to the related art;

FIG. 2 illustrates a disassembled perspective view of a mobile communication terminal with an integrated photographic apparatus and an inverse image reversing apparatus according to one embodiment of the present invention;

FIG. 3 illustrates a longitudinal sectional view of an integrated photographic apparatus of mobile communication terminal having an inverse image reversing apparatus according to one embodiment of the present invention;

FIG. 4 illustrates a perspective view of an integrated photographic apparatus of a mobile communication terminal and a connection method of a magnet according to one embodiment of the present invention;

FIG. 5 illustrates a sectional view of a mobile communication terminal with an integrated photographic apparatus directed away from the internal surface of the terminal according to one embodiment of the present invention;

FIG. 6 illustrates a sectional view of a mobile communication terminal with an integrated photographic apparatus directed towards the internal surface of the terminal according to one embodiment of the present invention; and

FIG. 7 illustrates a diagram of the flux direction of a magnet in an inverse image reversing apparatus of mobile communication terminal with an integrated photographic apparatus, according to one embodiment of the present invention.

[0019] Features, elements, and aspects of the invention that are referenced by the same numerals in different figures represent the same, equivalent, or similar features, elements, or aspects in accordance with one or more embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Reference will now be made in detail to one or more embodiments of the invention, examples of which are illustrated in the accompanying drawings.

[0021] In FIG. 2, a mobile communication terminal 100 with an integrated photographic apparatus 160, in accordance with one embodiment of the present invention, is

illustrated as, for example, a folding type terminal. The terminal comprises a lower body 110 in which a printed circuit board 120 is installed. Alternatively, the printed circuit board 120 may be installed in the upper body 130. The upper body 130 is shown to have a display 140, such as a liquid crystal display, on the lower surface of the upper body 130. The photographic apparatus 160 is rotatively installed on one side of a hinge connection element 150, which rotatively connects the upper body 130 to the lower body 110. The photographic apparatus 160 is installed so that it has an approximate range of rotation of 180°.

[0022] A magnet 200 is preferably fixed to the interior surface of the photographic apparatus 160. However, the magnet 200 can also be fixed on an external surface of the photographic apparatus 160. The magnet 200 is preferably formed in an arc shape in order to widen the magnetic flux continuously emitted by the magnet 200, as well as vary the magnetic flux density (*i.e.*, higher density in the center of the magnet versus lower density towards the edges of the magnet). As shown in FIG. 3, the outer circumferential surface "Rm" of the magnet 200 is preferably curved to approximate the curvature of the inner circumferential surface "rc" of the photographic apparatus. Therefore, the surface contact between the magnet 200 and the photographic apparatus 160 is maximized.

[0023] Referring to FIG. 4, the magnet 200 is fixed to the photographic apparatus 160. A first guide rail 161 is formed on the inner circumferential surface "rc" of the photographic apparatus 160 opposite a second guide rail 162. The first and second guide rails 161, 162 are approximately "C" shaped and spaced a distance apart in order to receive and fixedly secure the magnet 200. Alternatively, an adhesive well known in the art may be used to secure the magnet 200.

[0024] In FIG. 5, a flux detecting sensor 210 is shown fixed to the printed circuit board 120 in the lower body 110 of the terminal 100. The sensor 210 detects the density of the

magnetic flux emitted by the magnet 200. The sensor can alternatively be installed in other locations of the terminal 100 in order to detect the magnetic flux density of the magnet 200. When a user rotates the photographic apparatus 160 a predetermined angle, the magnet 200 is displaced from its original position. The magnetic flux sensor 210 detects the flux density variation resulting from the displacement of the magnet 200 and emits a signal to the printed circuit board.

[0025] Referring to FIG. 5, when the photographic apparatus is rotated from 330° to 90° (based on 0° corresponding to the twelve o'clock position), the rotation angle Θ is less than or equal to approximately 150°. Consequently, when the photographic apparatus 160 is generally oriented in the direction "A" (which corresponds to approximately 90°), the image created by the photographic apparatus 160 is correctly reproduced on the LCD screen 140 with respect to orientation. Also, when the rotation angle Θ is less than or equal to approximately 150°, the magnetic flux sensor 210 and magnet 200 are not relatively approximate to each other.

[0026] However, when the photographic apparatus 160 is rotated so that the rotation angle Θ exceeds approximately 150°, the photographic apparatus 160 is inversely positioned and faces the user (*i.e.*, the photographic apparatus 160 is directed in the same general direction "B" as the LCD screen 140), as shown in FIG. 6. Consequently, the image photographed by the photographic apparatus 160 is inverted since the rotation of the photographic apparatus 160 is more than approximately 150°. This results in the photographic apparatus 160 as being oriented upside-down. However, rotation of the photographic apparatus 160 also results in positioning the magnet 200 approximate to the magnetic flux sensor 210. In detecting a magnetic flux density, the sensor 210 emits a signal to the printed circuit board 120, which inverts the image to be correctly reproduced on the LCD screen 140.

[0027] FIG. 7 illustrates that, due to the arc shape of the magnet 200, the amount of flux directed towards the sensor 210 is maximized. Furthermore, variation in flux density can also be detected by the sensor 210 in order to gradually reorient the reproduced image for greater accuracy. Alternatively, the terminal's software, firmware, or circuitry can be programmed or constructed so that rotation of the photographic apparatus 160 repositions the magnet 200 away from the sensor 210. As a result, the sensor, in detecting a lack of magnetic flux density, signals for inversion of the image.

[0028] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Therefore, the foregoing description of these embodiments of the present invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents. Preferred embodiments were shown in the context of folding type mobile communication terminals. In alternative embodiments, candy bar and PDA type terminals can be substituted for the present invention.